

CLAIMS

What is claimed is:

- 1           1. A transparent multi-layer coating for a substrate, comprising:  
2           a surface-hardening layer formed over the substrate;  
3           a multi-layer abrasion-resistant coating formed over said surface-hardening  
4           layer; and  
5           a hydrophobic dry coating formed over said multi-layer abrasion-resistant  
6           coating.
- 1           2. The coating of claim 1, wherein said abrasion-resistant coating  
2           comprises alternating layers of silicon dioxide and zirconium dioxide.
- 1           3. The coating of claim 2, wherein said abrasion-resistant coating  
2           sequentially comprises a silicon dioxide layer, a zirconium dioxide layer, a silicon  
3           dioxide layer, a zirconium dioxide layer, and a silicon dioxide layer.
- 1           4. The coating of claim 3, wherein said abrasion-resistant coating  
2           sequentially comprises a silicon dioxide layer of approximately 907 angstrom, a  
3           zirconium dioxide layer of approximately 765 angstrom, a silicon dioxide layer of  
4           approximately 174 angstrom, a zirconium dioxide layer of approximately 246  
5           angstrom, and a silicon dioxide layer of approximately 2616 angstrom.
- 1           5. The coating of claim 1, wherein said hydrophobic coating comprises a  
2           perfluoroalkylsilane layer formed by a dry coating technique.
- 1           6. The coating of claim 5, wherein said perfluoroalkylsilane layer has a  
2           thickness of approximately 5-20 nm.

1           7.     The coating of claim 1, wherein said hydrophobic coating and said  
2 multi-layer abrasion-resistant coating are both dry coatings formed by a vacuum  
3 coating technique.

1           8.     The coating of claim 1, wherein said hydrophobic coating and said  
2 multi-layer abrasion-resistant coating have substantially equal thermal coefficients of  
3 expansion.

1           9.     The coating of claim 1, wherein said surface-hardening layer is an  
2 organo-silicon polymer material.

1           10.    The coating of claim 9, wherein organo-silicon polymer material is  
2 triethoxymethyl silane.

1           11.    The coating of claim 9, wherein said organo-silicon coating has a  
2 thickness of approximately 2-3 microns.

1           12.    The coating of claim 1, wherein said coating is formed on a glass  
2 substrate.

1           13.    The coating of claim 1, wherein said coating is formed on a polymer-  
2 based substrate.

1           14.    The coating of claim 1, wherein said coating is formed on an  
2 automotive window.

1           15.    The coating of claim 1, wherein said coating is formed on an  
2 automotive mirror.

3 forming a surface-hardening layer over said substrate;

7        depositing a hydrophobic coating over abrasion-resistant coating using a dry  
8    coating technique.

1            17.    The method of claim 16, wherein said abrasion-resistant coating and  
2    said hydrophobic coating are dry coatings which are formed by a vacuum deposition  
3    technique.

1           18. The method of claim 16, wherein said abrasion-resistant coating is  
2   formed to sequentially comprise a silicon dioxide layer, a zirconium dioxide layer, a  
3   silicon dioxide layer, a zirconium dioxide layer, and a silicon dioxide layer.

1           19. The method of claim 18, wherein said abrasion-resistant coating is  
2   formed to sequentially comprise a silicon dioxide layer of approximately 907  
3   angstrom, a zirconium dioxide layer of approximately 765 angstrom, a silicon dioxide  
4   layer of approximately 174 angstrom, a zirconium dioxide layer of approximately 246  
5   angstrom, and a silicon dioxide layer of approximately 2616 angstrom.

1           20.    The method of claim 16, wherein said hydrophobic coating comprises  
2   perfluoroalkylsilane.

1           21.     The method of claim 20, wherein said perfluoroalkylsilane coating is  
2     formed to have a thickness of approximately 5-20 nm.

1           22.     The method of claim 16, wherein said hydrophobic coating and said  
2     abrasion-resistant coating have substantially equal thermal coefficients of expansion.

1           23.     The method of claim 16, wherein said surface-hardening layer is an  
2     organo-silicon polymer material.

1           24.     The method of claim 23, wherein organo-silicon polymer material is  
2     triethoxymethyl silane.

1           25.     The method of claim 23, wherein said organo-silicon layer is formed to  
2     have a thickness of approximately 2-3 microns.

1           26.     The method of claim 1, wherein said coating is formed on a glass  
2     substrate.

1           27.     The method of claim 1, wherein said coating is formed on a polymer-  
2     based substrate.

1           28.     The coating of claim 1, wherein said coating is formed on an  
2     automotive window.

1           29.     The coating of claim 1, wherein said coating is formed on an  
2     automotive mirror.

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